the Mechelecin

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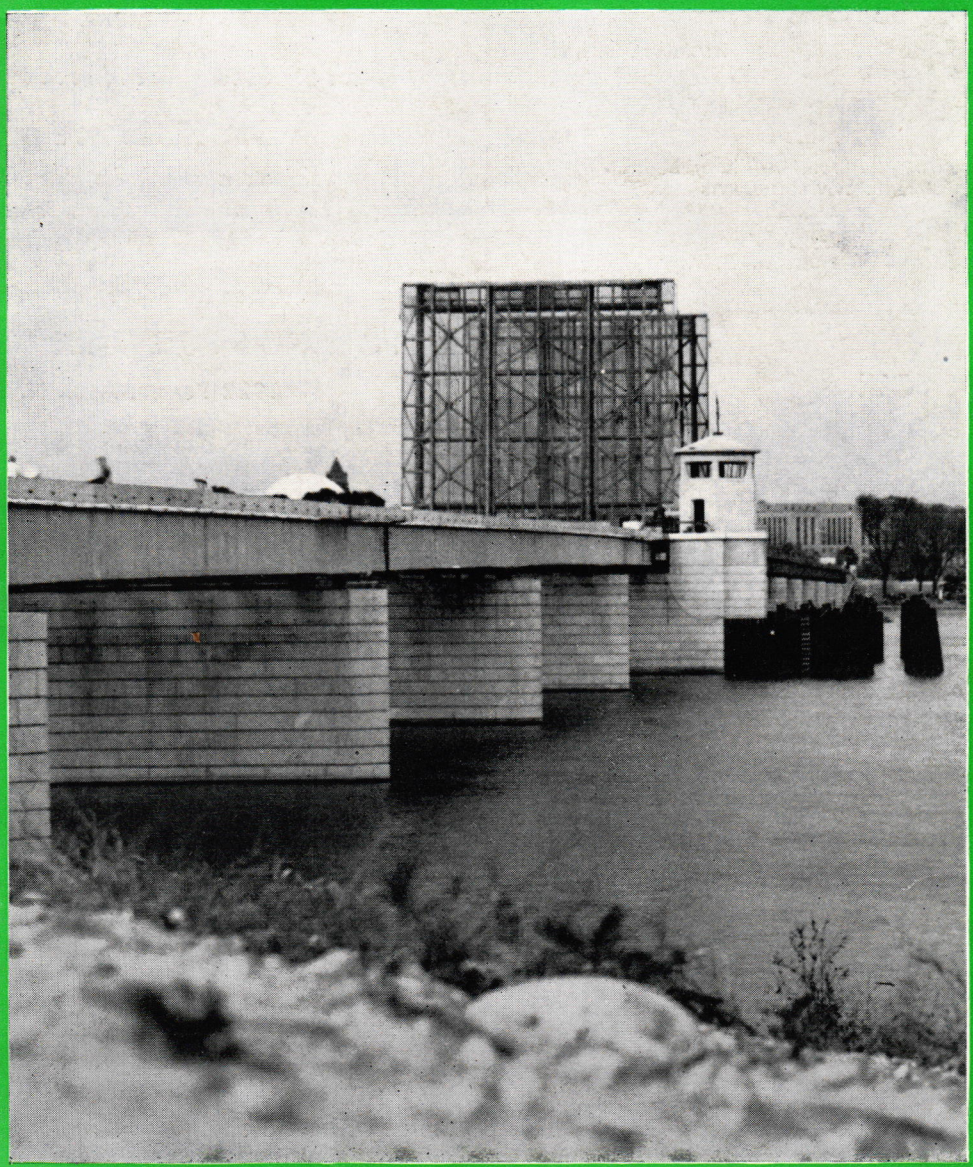

THE SCHOOL OF ENGINEERING
THE GEORGE WASHINGTON UNIVERSITY

THE MECHELECIV

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• THANK YOU!

The resignation this month of Professor F. H. Kohloss from the post of Faculty Advisor of Mechel-eciv brings to a close two years of hard work and sincere criticism, plus serious efforts to promote the magazine on his part. He was not easy to sway when we thought up fantastic schemes, or tried to grow up overnight, but neither was he easy to discourage when our problems seemed too difficult for us to master.

The simple presence on the campus of our magazine at this time is a testimonial to his untiring efforts, plus the efforts of a great many students who worked on the magazine during the period that he was our Advisor. We do not know who writes the rules Faculty Advisors must follow, nor do we know what rules they have written, but we feel confident that those rules have been followed to the letter on our magazine for the past two years.

• TEAR IT DOWN!

Every time we enter the "X" building, at 23rd and G Sts., the crying need for honorable retirement of this old veteran becomes more obvious.

This building was built during the war as a barracks, and was converted into a classroom after it became evident that Washington was in no danger of attack. It has served for some years as a classroom, largely for ME drawing classes. The building was intended to be temporary, and its condition is now so bad that no further classes should be held there.

While we realize the need for every available classroom, this poorly heated, dilapidated old building has done its part. Every time someone walks across the room all drawing must cease until the floor stops vibrating. If any further classes must be held there, we hope that at least the powers-that-be will see to it that no more drawing is scheduled in this building.

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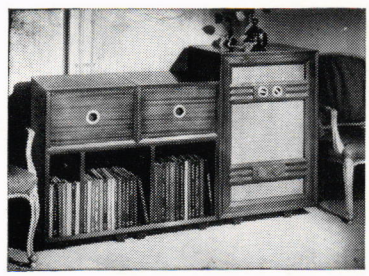

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About our cover—The cover photograph shows the partially completed structure of the new Fourteenth Street (or Highway) Bridge from the Virginia side. The bridge is scheduled for completion in March, 1950.

from the editor's mailbox

This space is intended to serve as a forum for student opinion. Opinions expressed are those of the writers, and not necessarily those of the MECHELECIV. *Address communications to: Editor's Mailbox, the Mechelecіv, Bender Bldg., George Washington University.*

—THE EDITORS.

October 10, 1949

Dear Editor,

I have a matter I would like to discuss in your columns, about the type of instruction in some departments here at the University. I am an engineering student, and am required to take several courses in Physics, which I have now completed. Looking back over the courses, I have some criticisms to offer.

It seemed to me that the Physics 5, 6 and 7 courses were pretty well handled as subjects. The lectures certainly seemed to know what they were doing, but the laboratory instructors for the most part did not seem to know much of what was going on. On one occasion our lab instructor gave us a bunch of stuff to study for the mid-term coming up, and the examination was an entirely different type of exam, for which our preparation was worthless. Then to make matters worse they grade those exams as if their life depended on the tiniest detail. I know physicists don't think much of engineers, and may even consider them pretty dumb, but after all we are required to take their courses, and can't help ourselves.

I believe the whole approach of the Physics department to Physics 8 is wrong. That is a course that would make a swell lecture course three time a week with no problems involved. It is very interesting stuff, but we should try to get only the theory in a broad sense, without going into all of those fine details that don't mean a thing to us. And it certainly is sad when half of a class flunks and most of the others get D. It means something is wrong.

—K.M.A.

• *Our own experience leads us to feel that your point about Physics 8 is well taken, K.M.A.*—ED.

Sirs:

In the October issue of Mecheleciv a person who identified himself only as "Disgusted Senior" registered his gripe in the editor's mailoox column. Those of you who read that article will recall that the author started off by asking the editor, "Why don't you make the presidents of the Engineering societies get to work and plan a good program with good technical speakers, plenty of interesting field trips, and a good social program?"

To begin with, I would like to say that I, too, believe that some (or perhaps many would be a more fitting word) of the previous programs and events failed to fulfill the desires of the majority. BUT, I would also like to say that the presidents of the various societies don't just decide on the programs individually and make the arrangements based on their own decisions. The various officers set up program and planning committees from volunteers among the members of the society. Thus, the officers are fortunate or unfortunate along this line depending upon whether there happen to be an abundance of conscientious members willing to accept the job. True, the officers are not relieved of the responsibility after they select the committees, but from there on in can offer suggestions and, if necessary, reject programs they deem inadvisable. The point I want to get over is that the success of the societies depends on the members as a whole. Just because a person isn't elected to one of the offices doesn't mean that he has no part in "running the show." Indeed, the primary purpose of all the student branches is to promote participation and cooperation in the various activities.

If the author of the article in question wishes merely to sit back and be entertained as a consequence of the efforts of his fellow engineers, then I suggest that he stick to his decision to refrain from joining the society. On the other hand, I am sure that if he possesses an earnest desire to partake of the advantages possible in being a member, then he need only volunteer as a member of the program committee and I say with absolute assurance that he will be only too gladly received.

I hope that this discussion will serve to convey the idea to all engineers that the student branches are dependent for their success upon the participation of all the members. Perhaps a good percentage of the engineers around school feel that they can't afford the time to be active in their student branch, but remember we are all in the same boat and if every member did something, then, as they say in the calculus, the time required per man would approach zero as the benefits approached infinity. In plain language, let's all pitch in and pull together for our mutual benefit.

Norman Henry
Chairman, ASME

• *"Disgusted Senior" really brought out the correspondence. Most mail we've had in years. Sorry we can't print them all.* —ED.

New Potomac River Generating Station
of the POTOMAC ELECTRIC POWER COMPANY

by R. G. Daniels

from data furnished by Potomac Electric Power Company

This is the first of a series of articles which the Mechelecivplans to present on progressive engineering firms and their projects in the Washington area. Some outstanding governmental projects may be discussed also.

The very rapid increase in population and use of electricity in the Washington, D.C. metropolitan area during the war and post-war era, has created a tremendous increase in the need for all phases of electric utility construction. In 1945 a 50,000 kilowatt unit was placed in operation at the Buzzard Point plant and two years later a similar unit was added at the Benning plant. Despite these additions, which brought the generating capacity in the Washington area to a total of 505,000 kilowatts, it was evident that a site for continued expansion of the generating facilities was essential. Land for the Potomac River plant in Alex., Va. was aquired in 1942 and final plans place five 80,000 kilowatt units, or 400,000 kilowatts, on the site. The present building will house two of the 80,000 kilowatt units; one unit was placed in operation in October, while the other unit is expected to go on the line in May of 1950.

Practically all land adjacent to the Potomac or Anacostia Rivers in the District of Columbia proper is occupied by parks or government airfields. The Alexandria site was selected as being the closest available one that could be acquired adjacent to a good volume of river circulating water having railroad facilities that are necessary for the huge volume of coal that will normally be burned. This site is also located so that transmission cable tie-in can be economically made with the existing P.E.P.Co. system. Since the site is located in the State of Virginia, it was a legal requirement for P.E.P.Co.'s subsidiary, the Braddock Light and Power Company Incorporated, to own and operate the new Alexandria plant, together with transmission facilities up to the District of Columbia line..

Potomac River Generating Station

—Duncan photo

Steam Power Facilities

The station is designed on a strict one boiler-one turbine arrangement with each boiler connected directly to an 80,000 kilowatt turbine-generator. There are no cross-connections between the boilers or turbines. The only steam driven auxiliaries in the plant are one auxiliary lubricating oil pump on each turbine generator.

Steam for each turbine is supplied by a single boiler operating at steam conditions of 875 psi pressure and 925 F temperature at the superheater outlet. Each boiler has a capacity of 800,000 pounds of steam per hour and is designed to burn bituminous coal, natural gas, or oil, although initially facilities have been installed for burning only coal for generating electricity. A light fuel oil system is installed for lighting the coal but this is for ignition purposes only.

The furnaces are fully water cooled and arranged with shielding type dry hopper bottoms for discharging dry ash into pits from which the ash is removed by a vacuum system. Each boiler furnace is 34 feet wide and 25 feet deep. The height of the boiler room from basement floor to roof is 127 feet—equivalent to the height of an eleven-story building.

To completely cover the plant and its operation, let us follow the process from coal to electrical power on one hand and ashes and smoke on the other.

Ordinary bituminous coal from Pennsylvania or West Virginia is delivered to the plant railroad siding, which has storage facilities for approximately 100 railroad cars. These cars are weighed on a track scale which provides a stamped weight ticket for each car of coal. The present capacity of the coal-handling system is 350 tons of coal per hour. This

can be increased in the future to 700 tons per hour by installing additional belt conveyors.

The coal cars are emptied by a rotary car dumper which turns the car upside down and dumps the coal into a steel hopper. From here it is fed onto an inclined rubber conveyor belt which delivers the coal to a Bradford coal breaker. This breaker is a large revolving steel drum with 1½ inch holes in it through which the coal drops as it breaks up, while any foreign matter that will not break up is rejected from the end of the revolving drum. Coal from this breaker can be routed either to the coal storage area or to an inclined belt conveyor system which delivers coal to the bunkers in the station. A magnetic pulley is installed ahead of the coal bunkers to remove any small pieces of tramp iron which might have gone through the Bradford breaker screen. One coal bunker is provided for each boiler. Each bunker has a capacity of about 1200 tons of coal.

Every effort has been made to render the handling of the coal as dustless as possible. The rotary railroad car dumper is totally enclosed, with a rolling steel door in each end of the enclosure to permit the shifting of full cars onto the dumper and the removal of the cars after they have been dumped. An elaborate system of dust collecting equipment has been provided for the rotary car dumper house, the coal bunkers in the station, and at all intermediate points where dust can be created by the coal being transferred from one conveyor belt to another. A chemical spraying system is provided to wet all coal to the storage field. After the storage pile is shaped up, it will be sprayed with heavy bunker oil to prevent it from blowing in dry weather.

The bituminous coal flows from the bunker through small motor-driven coal feeders which regulate the flow of coal to the Raymond Bowl coal pulverizers in accordance with the boiler loading. The coal pulverizers grind up the coal to the consistency of face powder, mix it with air, and blow the coal-dust laden air through burners into the furnace where it burns almost as a gas or oil. Each pulverizer can handle 14 tons of coal per hour and there are four pulverizers per boiler.

There is a small percentage of incombustible material in all coal which remains in the form of ash or cinders after the coal is burned. Approximately 20 percent of this ash will collect in the ashpit under the furnace. This ash is removed from the ash hoppers in a dry state and is taken to the ash silos by means of vacuum piping. To control the fly ash a Cottrell Precipitator and a mechanical precipitator are used in series to remove better than 99 percent of the suspended matter in the flue gases. The Cottrell Precipitator consists of collecting plates charged to 75,000 volts direct current which is provided by mechanical rectifiers. The ash collected in both precipitators is removed by the same vacuum piping system that is used to clear the ash hoppers.

Dustless unloaders mix the collected ash with water and load it into trucks which haul it away for disposal. The delivered and erected cost of the equipment required for collecting and handling this ash is approximately $400,000 per boiler.

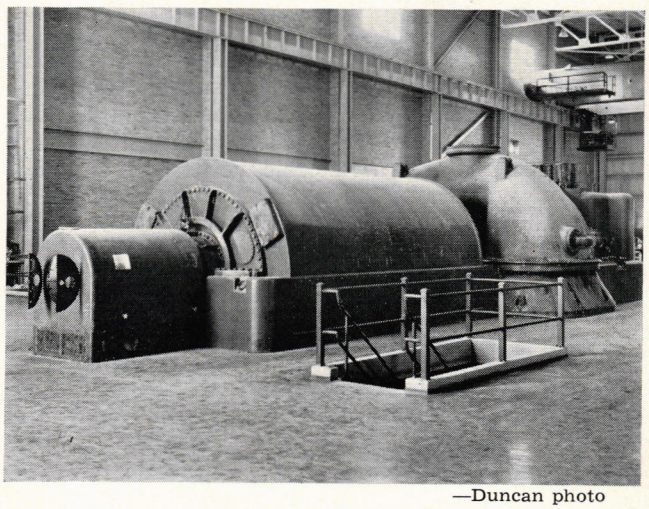
The boiler is a Combustion Engineering three-drum hopper-bottom unit, producing 800,000 pounds of steam per hour at 875 pounds pressure and 925 F to run the turbine. The flame in the furnace is about 3,000 F and the hot gas leaving the furnace is about 2000 F, finally leaving the stack at 330 F.

The flame and hot gas in the boiler furnace heat the water in the tubes and turn this water into steam which then flows through a super-heater to heat the steam to a still higher temperature before it flows to the turbine.

The superheated steam from the boiler is piped to the turbine through a 16-inch diameter alloy steel pipe. The steam in this pipe is so hot that if the bare metal were exposed, it would probably glow slightly in the dark. Not all of the steam that goes to the turbine passes all the way through; some steam is extracted at five points along the turbine casing and is used again for heating the feedwater going to the boiler. Bleeding steam from the turbine to heat the water fed to the boiler is justified for

(*Continued on page fifteen*)

80,000 KW hydrogen-cooled turbine-generator



—Duncan photo

The Isotopic Configuration Chart

by Arthur F. Souther

This article presents a new concept in Physics which was developed by the Author. The material presented is not vouched for by the Mechelecіv. While the subject matter is not strictly within the intended scope of this magazine, George Washington University publishes no scientific journal, and therefore the Mechelecіv is carrying the article as a service to science.

The isotopic configuration chart showing the four natural nuclei series was conceived and drawn in October, 1947. The chart was first presented to faculty members at George Washington University late in 1947. In 1948 the author discussed the chart and certain laws which were derived therefrom with Dr. Valenti of Georgetown University, Professor Enos Whitmer of the University of Pennsylvania, Dr. Paul Abelson of Washington's Carnegie Institute, and physicists of the Institute of Advanced Studies at Princeton University, the National Academy of Science, the Bureau of Standards, and the Catholic University.

More than a score of the nation's top-flight physicists studied the chart during sessions of the American Physical Society at George Washington University last spring.

Since this time the discovery of the four natural series has been independently confirmed by W. D. Harkins and Martin Popelka, Jr., in an article appearing in the October 1, 1949, issue of the *Physics Review.*

On the Structural Pattern of the Elements and Laws Relating Thereto

In 1913 J. J. Thomson, investigating Crookes' conjecture that atomic weights of elements might be integral, discovered isotopy. Thomson found that atomic nuclei of an element might have different integral mass values; and that the atomic weight was an average of the weights of the isotopes which an element possessed. Thus chlorine's atomic weight of 35.46 was an average of two isotopes of mass 35 and 37 present in nature in the relative abundancies of 75.4 and 25.6%. As the chemical periodic table was first constructed by use of atomic weights, scientists sought to relate the extra- and intra-nuclear characteristics of atoms, in order to uncover the laws governing the structure of elements. Consequently, isotopes were classified in two systems, the Z or atomic number system, and the N or neutron level system. The two systems revealed a number of regularity features, but neither classification achieved the end of revealing fundamental physical laws applicable to the whole charge-mass heirarchy. The rules of both systems were subject to many exceptions.

In his monumental work in isotopes Aston found several relationships associated with the factor of odd and even atomic number and odd and even mass number.

Aston found that all stable isotopes of odd atomic number except hydrogen, lithium, boron, and nitrogen had only odd mass values. Even atomic number elements usually possessed both odd and even mass. No isotopes were found for atomic numbers 43 or 61, and, curiously, argon and cerium were the only even atomic numbered elements without odd mass isotopes. Of significance was Aston's discovery that no element except tin had more than two odd mass isotopes. Many elements had only one such nucleus.

Since Aston's findings, physicists have sought in vain to explain the odd atomic number odd mass phenomena. The present article will show how solving this enigma reveals the inherent simplicity of the structure of nature's elements. The accompanying isotopic configuration chart combines for the first time the sequence of the periodic table with the Z and N classification systems, reveals the mass-charge heirarchy, the systematic intra-nuclear reorganization of the proton-neutron level, and the workings of the natural physical laws distributing a given atomic number or charge to a particular mass.

The Law of Series

All stable atomic nuclei exist as members of four natural series. If their mass number is odd, the nuclei are members of the Alpha or Gamma series; if their mass number is even, the nuclei are members of the Beta and Delta series. Each series has a unique base constant which is a component of every nucleus of that series.

	Proton	Neutron	Charge	Mass	Base Constant
Alpha	2	1	2	3	$_2He^3$
Beta	1	1	1	2	D
Gamma	1	0	1	0	$_1H^1$
Delta	2	2	2	4	$_2H^3$

This law expresses the fact that all nuclei having the same particular kind of mass deficit preventing a nucleus of a series from achieving a symmetry wherein the mass is an exact multiple of four, have certain

(*Continued on page eighteen*)

ISOTOPIC CONFIGURATION CHART

-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
δ	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ	α	β	γ	δ	α
			1 0 1 99.9																		
1 1 2 <1	2 1 3	2 2 4 100																			
3 3 6 7.5	3 4 7 92		4 5 9																		
5 5 10 18.4	5 6 11 81.6	6 6 12 99	6 7 13 1.0																		
7 7 14 99.6	7 8 15 0.38	8 8 16 99.76	8 9 17 .04	8 10 18 0.2																	
	9 10 19 100	10 10 20 90	10 11 21 .27	10 12 22 9.73																	
	11 12 23 100	12 12 24 77.4	12 13 25 11.5	12 14 26 11.1																	
	13 14 27 100	14 14 28 89.6	14 15 29 6.2	14 16 30 4.2																	
	15 16 31 100	16 16 32 95.1	16 17 33 .74	16 18 34 4.2		16 20 36 0.02															
	17 18 35 75.4	18 18 36 0.31	17 20 37 24.6	18 20 38 0.46		18 22 40 99.6															
	19 20 39 93.4	20 20 40 96.96	19 22 41 6.61	20 22 42 0.64	20 23 43 0.15	20 24 44 2.06		20 26 46 .003													
			21 24 45 100	22 24 46 7.95	22 25 47 7.75	22 26 48 73.95	22 27 49 55.1	22 28 50 5.34													
				24 26 50 4.49	23 28 51 100	24 28 52 83.78	24 29 53 9.43	24 30 54 2.30													
				26 28 54 6.4	25 30 55 100	26 30 56 91.57	26 31 57 2.11	26 32 58 0.28													
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											39 50 89 100	40 50 90 48.0	40 51 91 11.5	40 52 92 22.0		40 54 94 17.0		40 56 96 1.5			
										42 50 92 14.9	41 52 93 100	42 52 94 9.4	42 53 95 16.1	42 54 96 16.6	42 55 97 9.65	42 56 98 24.1		42 58 100 9.25			
										44 52 96 5.7		44 54 98 2.2	44 55 99 12.8	44 56 100 12.7	44 57 101 16.98	44 58 102 31.34		44 60 104 18.27			
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																		54 70 124 .09		54 72 126 .09	53 74 127 100
																				56 74 130 0.1	

UPPER LEFT CORNER - Z NUMBER

UPPER RIGHT CORNER - N NUMBER

CENTER – MASS NUMBER

LOWER RIGHT CORNER - RELATIVE ABUNDANCY

NEWS AND VIEWS

Mixer Highly Successful

Swept along by the enthusiastic response to their 'smoker' type mixer, held October 5th at Ruby Foo's Den, the Engineers' Council has determined that this type of opening meeting is far more satisfactory in introducing new students and entering freshmen to professors and upper classmen in the Engineering School than any of the previous technical meetings. This year's meeting was quite different from those held in previous years, in that it was held off campus, in an informal atmosphere, with beer and soft drinks being served so that the students gathered in small groups and actually got to talk to each other a little bit.

During the short program, Professor Carl H. Walther, Assistant Dean of the School of Engineering, gave the keynote address, using as his topic "Don't be a half-way engineer" to stress the fact that student participation in the engineering societies and fraternities is a valuable part of the individual's preparation for his future work in engineering. Professor Norman B. Ames, head of the Electrical Engineering Department, gave a short talk and introduced those professors from his department who attended. Professor Bruce D. Greenshields, head of the Civil Engineering Department, and Professor Benjamin C. Cruickshanks, head of the Mechanical Engineering Department, introduced members of their respective departments. Presidents of the Engineering societies and fraternities were introduced, and short talks were given by Bedford Robertson, president of Sigma Tau, and George Titrington, president of Theta Tau.

Bill Whittemore, acting as master of ceremonies, introduced several of the other guests, including alumnus Don Blanchard, business manager of the University. At an invitation for comments from the freshmen, Jim Smart made a few impromptu comments on freshman reaction.

During the evening, representatives of the societies, fraternities, and Mecheleciv were stationed at special tables to answer questions about their organizations and to enroll such new members as cared to join at that time. The main purpose of the evening was to promote such informal exchanges as well as to get acquainted. It became evident very early that the upper classmen returning for the fall semester were as anxious to renew old acquaintances in a social atmosphere as the entering students were to make new acquaintances. It was this general interest in an opportunity to obtain information, get your classmates names straight, and say hello to buddies, which caused the Council to decide to use this type of mixer in future programs.

Besier Elected to Council

R. F. "Dutch" Besier, a Mecheleciv staff member, was elected Member-at-large at the meeting of the Engineers' Council held October 13. The member-at-large is charged with the responsibility of representing the general student body in the Council. Each of the other Council members is elected by one

Speakers' Table at the Mixer. Professor Walther is at the microphone.

of the several societies or fraternities in the Engineering School, and therefore represents only his particular group.

"Dutch" came to George Washington University from Long Island, New York. He is twenty years old, and is a senior in the Civil Engineering curriculum. Among his many contributions to the progress of the Engineering School are his service on the business staff of the Mecheleciv, much work on the Inaugural parade float, and the cabinet which housed the short-lived Engineers' library. The industry, affability, and ability which has made "Dutch" popular and respected in engineering circles on campus will assure his success as a representative of all engineering students on the Council.

How Do You Pronounce It?

We are frequently asked about the pronunciation of our name, so here is the whole story. The word "Mecheleciv" is a combination of the beginning letters of the three main engineering degrees offered here at the University, Mechanical, Electrical, Civil. It is pronounced "MUH-KELL-UH-SIV", with the emphasis on KELL.

District Area Contracts Awarded

Contracts have been awarded recently on eleven major construction projects in the District of Columbia area, or to District firms, in addition to a number of smaller maintenance, repair, street, and sewer project awards.

Cramer-Vollmerhausen Co., of 2601 Connecticut Avenue, was successful bidder on the $1,300,000 women's dormitory at Howard University. Otis Elevator Company has a $40,000 contract for elevator installations at the same school. Contracts have been awarded for the construction of a new addition to Gallinger Hospital with the Joseph F. Nebel Company, of 2142 P Street, N.W., receiving the million and a half dollar contract. Otis Elevator is handling the elevator installations.

The new Woodward and Lothrop store being built in Chevy Chase will be constructed by the Charles H. Tompkins Company of Washington, who have built several of the structures here at George Washington University. Roscoe Engineering Company of 1025 Vermont Avenue, N.W., received the contract to construct a theatre and stores on Flower Avenue, Takoma Park, for Fred F. Kogod.

Blackwell Engineering Company, of Arlington, has been awarded a $350,000 government contract for construction of a tank and model basin, while McKinley Construction Company, also of Arlington, has been awarded a $200,000 contract for construction of 117 miles of REA line for Choptank Electric Cooperative. The Navy Department recently awarded a $140,000 contract for extensions to the FBI Academy at Quantico to Victor Beauchamp, of 6834 4th Street, N.W., Washington.

Proposed Engineering School Ring

The public got the first glimpse of a picture of the proposed ring for the engineering school recently at the Engineers' Mixer. The ring, designed by Josten, is similar to the present University ring except that the winged emblem on one side is replaced by a castle, emblematic of engineering, and the words "Engineering School." The enthusiasm of the many students and professors who viewed the new design leads to the expectation that it will soon become the official ring of the engineering school.

Assistant Dean Walther has already expressed his acceptance and it has been submitted to President Marvin for final approval. As soon as this official University sanction has been given, the new ring will be available to engineering seniors at the Student Supply Store, 2118 G Street, N.W,, opposite the Student Union building.

Engineers' Council Meeting

The Engineers' Council met at 8:15 p.m. on Thursday night, October 13, in the new Engineering activities office in the student union annex, with ten of the thirteen members reported present.

Reports by the editor-in-chief and business manager of Mecheleciv opened a general discussion of editorial policy and finances of the magazine, which is published under the sponsorship of the Council. The editor reported that Mr. Watson Davis, Alumni Advisor, has suggested that students continue to edit the magazine but that it be aimed principally at practicing engineers in this area, and contain articles of interest to them. The business manager was directed to submit a full financial report at each council meeting this year. The resignation of Professor F. H. Kohloss was considered. Professor Kohloss stated in his resignation that the pressure of his other activities prevented his continuing as faculty advisor. His resignation was accepted.

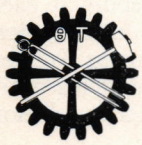
After the Treasurer's report, short reports were given by the Social Chairman and the Program Director, with the Social Chairman outlining the general plans for the Engineers' Ball, to be held in the spring. The Engineers' Mixer of October 5th was discussed. The members reported a satisfactory reception by each of their organizations. It was moved that the Program Director investigate the possibility of having another mixer of the same type in the first few days of the second semester, with the soft drink

(Continued on page fifteen)

● At the Engineer's Mixer, Bedford Robertson in speaking of the fraternity and its activities mentioned one facet of the organization that has the appearance of a golden opportunity. This item was the offer of free tutoring to any student that requests it. Bedford is often pleaded with, cajoled and offered bribes for such items as "just a set of D. C. lab experiments, even if a few of them are B's" or "some of those old Statics problems you're not using"—but, like he says, tutoring means tutoring. Although the problems are not available, out of the group of Sigma Tau there will be someone who is 'hot' on the subject that is giving you trouble.

Another item that was mentioned at the mixer worth stressing is the freshman award. Each year this award is presented to the freshman with the highest quality point index at the end of his first year. The award is a worthwhile recognition for freshmen. Engineering students are fond of telling each other and everyone else in general what a difficult course engineering actually is, and the top man is assured the respect of his fellow students.

The chapter has met once at the time of this writing, and found itself in a considerable state of flux on its proposed plans of an engineering library and the placement on the campus of the Ship's Bell. The former item seems tabled for some time, but alternative plans with Lisner library are under consideration. These plans include preparing a list of technical books that are often needed by engineering students and having these books placed on the reserve list, through proper channels, of course. This will eliminate a lot of needless waiting for essential texts. The Ship's Bell, a 600-pound object, was tossed back and forth verbally with apparent ease. At any rate, talk—the talk that must precede action, we sincerely hope—was the order of the day for Sigma Tau's initial session.



● On October the 8th Gamma Beta chapter of Theta Tau began the 1949-50 year with the initiation of nine more outstanding students in the engineering school. They are Robert Cashman, John Conner, Edward Egloff, George Gelly, Tom Mutchler, Barney Proctor, Pete Repak, and Thomas Shipp. This brings the chapter strength, reduced by the recent graduation of many lucky brothers, up to 31.

A week later the chapter also was proud to initiate Professor Charles E. Greeley of the Mechanical Engineering Department as an honorary member of the fraternity. Following the initiation the annual Founder's Day banquet, ably MC'd by Regent Titrington, and dance, in honor of the new members, were held in the Georgian Room of the Sheraton Hotel. Many of the alumni, recent and not so recent, were welcomed back by the present actives. Only the presence of our own "Deacon" Ames, absent as a result of his duties as Grand Regent of the fraternity, could have made the evening more perfect.

Plans for the annual Fall football game and oyster roast to be held November 11 at Meadowbrooke are nearing completion. Unfortunately the Maryland Park Commission frowns on oyster roasts so all members are advised to bring a little extra money along to bail themselves out of the 'clink' if necessary. Remember alumni, you have been challenged to a football game by the actives. Personally I think the score will be a little lopsided in favor of the actives, as they can field a line averaging over 200 pounds with Dick Koester, "Big John" McPhail, Bill Whittemore, "Steinmetz" Cashman, Regent Titrington, Frank Thompson, "John Paul" Conner, and others.

At the first regular meeting of the year a committee headed by Frank Thompson was appointed to investigate the possibility of securing a chapter house near the campus. Our first attempt, the Argonaut's house on 22nd Street, was foiled when powers above decided to tear down the house and turn it into a parking lot. So far no substitute has been found, but the committee is still looking for something.

● As far as the AIEE is concerned the **NEW** Fall Mixer was a big success. The number of new members signed up that night prove the old adage, that "wherever you can get a beer you'll find an engineer" or at least an engineering student.

For those EE's who missed the mixer there is still hope. They can sign up at the first meeting of the year, which will be held on Wednesday night, November 2, at 8:15 P.M. A joint meeting with IRE is planned with a speaker who will talk on a subject of interest to both societies.

To start the official season, Chairman John McPhail and Secretary Bob Kiernan stepped out with Professors Ames, Antel, and La Hatte to a luncheon meeting at Catholic University. At this meeting, attended by representatives of all student chapters in this area, they met the Vice President of the middle-eastern district of the AIEE, Mr. Cyril G. Veinott of Westinghouse. Mr. Veinott gave an interesting illustrated talk on the applications of small motors.

Faculty Advisor Jerry Antel and several of the officers are making plans to attend the district meeting on student activities to be held in Akron, Ohio, on November 4th and 5th. Any other members who would like to attend are urged to contact Professor Antel.

Scheduled for the coming year are field trips to points of engineering interest, technical movies, and speakers who will speak on subjects of interest to the Freshmen

as well as the Seniors. All members are urged to attend and take an active part in the functions of the AIEE.

P.S. Start thinking about a paper for the AIEE prize paper competition! Prizes this year are the largest ever. For details see any member of the EE Department or any of your chapter officers.

● The first meeting for this school year of the George Washington University student branch of the American Society of Mechanical Engineers will be held on Wednesday, November 2, at 8:15 p.m. in Government 101. Following the usual short business session, Mr. Lawrence Goodrich from the U. S. Patent Office will speak on the subject "Patents from the Viewpoint of the Engineer."

The program committee, under the direction of Bob Curtis, has scheduled a series of outstanding speakers on subjects of general interest to student mechanical engineers. ASME has some really big plans brewing, so come out to the meetings and get the maximum benefit out of your membership.

The Washington section of the ASME advises us that a new column featuring news notes from the campuses of local engineering schools is being established in the Washington Area Mechanical Engineer, their monthly magazine. A correspondent will soon be appointed for this university. His name will be announced when available, and all ME's are invited to contribute items to him for publication. Free copies of the ASME magazine will be available to all members of the student branches of the ASME through their faculty advisors.

Your attention is invited to a letter from Norman Henry, our chairman, which appears (we hope) in the "Editors' Mailbox" section of this issue of the "Mechaleciv."

● The first meeting of the IRE for the new school year will be held on Wednesday, November 2nd at 8:15 p.m. in Government 102. The subject for the technical discussion will be "Supersonic Testing of Materials," by Dr. Firestone, who has done the primary research on the testing apparatus and is the outstanding authority on this subject. At the conclusion of the discussion of the testing apparatus there will be an exhibition of some of the materials that have been tested.

At the short business meeting following the speakers, plans for the coming year will be made and definite dates for events announced. At the present time field trips are planned to the two Westinghouse plants in Baltimore and to a nearby tube dielectric heating plant. One of the Westinghouse plants is the electronics division where various radio equipment is designed and tested and where large transmitting units are assembled. Arrangements for transportation to Baltimore for this field trip will be made at the meeting.

Your suggestions for field trips and technical topics will be given special consideration and every effort will be made to carry them out during the coming year. Remember! These meetings are planned to interest you and ideas from all on making the program more interesting should be voiced.

● To all of you CE's and future Bachelors of Science in Engineering, the George Washington University student chapter of the American Society of Civil Engineers extends a hearty invitation to join our fold as our 1949-1950 program starts off with four days of activity during the first week in November. This year the national organization is holding its fall meeting in Washington, D. C., November 2nd through 4th. A special student's day will be held on Tuesday, November 1st, when future civil engineers from all over the country will gather to attend optional all day inspection trips as follows:

Trip No. 1—**Highways and Construction**—Consists of an inspection of the Highway Research Laboratories of the Bureau of Public Roads at Arlington, luncheon at the Pentagon Building, and afternoon inspection trips to several highway, bridge, and building construction jobs in and near Washington.

Trip No. 2—**Mapping, Bureau of Standards**—An inspection trip through the Arlington photogrammetric laboratory of the U. S. Geological Survey in the morning, with luncheon at the Pentagon Building, the afternoon to be spent in an inspection trip through the research laboratories of the National Bureau of Standards.

Trip No. 3—**Sanitary Engineering**—An inspection trip through the Dalecarlia Filtration Plant of the District of Columbia water supply system, and through the Blue Plains Sewage Treatment Plant. Luncheon will be en route at one of the government building cafeterias.

Trip No. 4—**Naval Research Laboratories**—A visit to the Naval Ordnance Laboratories at White Oak, Md., followed by luncheon at the cafeteria there, and an afternoon trip to the David Taylor Model Basin at Carderock, Md.

Registration for the meeting and trips will be at the Statler Hotel, 16th and K Streets, N.W., in Washington from 8:00 A.M. to 9:00 A.M. Busses for the above trips will leave the Statler promptly thereafter, and will return to the Statler at approximately 5:00 P.M. The day will be rounded out with a dinner and evening program.

All students desiring to attend the day's festivities and a special field trip on the following morning will be looked upon with favor by the Civil Engineering faculty,

(*Continued on page seventeen*)

ALUMNEWS

Alumni are urged to keep their friends posted on what they are doing by submitting items of interest for use in these columns. Please include your address.

"WALLY" KISTLER, BME 49, returned to the old school for the Engineers' Mixer. He is doing graduate work at Maryland. He is also Assistant Librarian at the engineering library there. JIM WARLICK, BME 49, is also a graduate student at Maryland, as is ERNEST EVERETT, BME 49.

BILL GUERRANT, BME 49, also came back to hoist a few with the boys at the Mixer, and tells us about a little hoisting he does every day at the Ft. Belvoir Engineering Research and Development Laboratory.

More GWU alumni have been found at the Bureau of Standards. FRANCIS FALKENBERG, BME 48, is doing large-scale testing in the Engineering Mechanics Division. LOUIS RICHMOND, BME 48, is in the Ordnance Division. NORRIS HEKEMIAN and CALVIN SALZBERG, both BEE 49, are in the Radio Propagation Laboratory. KEITH ALLEN, BME 49, is in the Combustion Research Laboratory. Keith goes into double harness this month. Who the lucky girl is we didn't find out. Brother Allen was last year's Business Manager of the Mecheleciv.

LARRY FREEMAN BEE, BME 49, who carried 24 hours his last semester to achieve the above distinction, is with the Raytheon Corp. in Boston, Mass. Also up Boston way is "ART" MACHLIN, BEE 49, one of those very lucky graduate students at "Hahvard", no less.

WALLY DYER, BME 48, is in Berwick, Pa. with American Car and Foundry Co.

JOHN McCUBBIN, BME 49, and PETE CLAWSON, BME 49, are working on their Masters' degrees at night over at "Terrapinville." John works at the Bureau of Ships and Pete is at the David Taylor Model Basin.

Another graduate who has transferred his affections from Corcoran Hall to Stockton Hall is RAY COULOMB, BME 48, who is also working at the Patent Office.

While we were interviewing PHILAS H. GIROUARD for the Profile elsewhere on this page, he told us about the remarkable job GWU alumni have done and are doing in the Defense organization. Among these alumni are PAUL W. BURK, BS in ME 26, ARTHUR J. STANTON, BS in ME 25, FORREST G. BITNER, BS in Eng 33 and BS in ME 37, JOHN M. STOCKARD, BS in ME (with distinction) 28, MICHAEL GOLDBERG, AM 29, and JAMES F. FOX, BS in ME 29, who are all doing more than a creditable job of representing GWU in the Bureau of Ordnance of the Navy Department. A more complete story about our alumni in the Navy Department will appear in a subsequent issue of the MECHELECIV.

Among the Alumni returning for the Theta Tau Founders' Day dinner and dance were J. HAROLD LINK, GEORGE CUNNEY, JULIUS RITTER, GEORGE KILPATRICK, DON BLANCHARD, HAROLD THOMASON, MATT FLATO, GEORGE PIDA, BILL GAINES, VANCE HENNESSY, FRED LEWIS, CHUCK MEYERS, VINCE TOAL, KEN BROWN, and MARTY ELF.

Dear Alumni: Everybody on this magazine gets mail but us. We have an extra large box but so far not a letter. Seriously though, the sole purpose of this page is to serve the alumni, to keep them in contact with the school and each other. Drop us a line, NOW, with some information on yourself or your buddies.

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ENGINEERING PERSONALITIES

ALUMNUS

In 1921 a remarkable young man appeared on the GWU campus. Five years and 155 credit hours later (all at night, by the way) this same young man was graduated with a BS in ME, *with distinction.* This phrase "with distinction" has marked the entire career of PHILIAS H. GIROUARD, President of the Engineering Alumni Association.

Mr. Girouard entered the Bureau of Ordnance, Department of the Navy, in 1917 at their lowest engineering level, copyist draftsman. Today he is Chief Engineer of the Bureau. He is also Chief Engineer of the Research and Development Division of the Bureau. His present position covers all phases of ordnance design, development, and research, including guided missiles. In connection with this position he does extensive traveling. Shortly after this interview he was scheduled to leave for England.

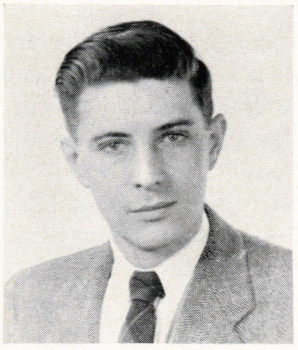
In recognition of outstanding accomplishments and contributions to the war effort he was awarded the "Distinguished Civilian Service Award" by the Secretary of the Navy in 1945. This award was specifically for work in rocket launching experimentation and design. He was also decorated for overall service with the highest civilian award in the United States, the "Medal of Merit," presented personally by the President, on behalf of his fellow citizens. In 1947 Dr. Alexander Wetmore, President of the GWU Alumni Association, presented Mr. Girouard with the Alumni Achievement Award for distinguished service to school and country.

Mr. Girouard was born September 8, 1896, in North Kingston, R. I. In 1921 he married Grace Brawner, a Washington girl. The Girouards have one daughter, seventeen year old Margaret Anne.

By way of advice Mr. Girouard says that nothing so handicaps an engineer as the lack of ability to express himself. He states that he has seen many cases of brilliant young engineers who for all of their technical knowledge could not advance because of inability to explain their ideas adequately. He also urged that all those who plan to do advanced engineering take postgraduate work, since those who do not have a Master's degree find themselves at a disadvantage in advanced fields.

The sincere congratulations of the undergraduate engineers go to PHILIAS H. GIROUARD, who throughout this career has served his country, his profession, and his school always "with distinction."

UNDERGRADUATE



BILL WHITTEMORE, in addition to being the president of the Engineer's Council, is actively engaged in a hatful of other activities. A careful search of his high school achievements reveals no overt talent that would point Bill out as a future member of George Washington University's Student Life Committee, an august group composed of members of the faculty and students which has the final say on every rule, regulation, and activity involving the undergraduate body.

Outstanding Whittemore achievements in high school involved marching and music. The high school cadets is an organization based on the old idea that if a man sticks with them long enough his reward will be great. At the end of three years Bill was made a sergeant in compensation for the fact that all his friends had long since become majors.

Graduating from Woodrow Wilson High in June of 1944, Bill spent some time working in the Bureau of Standards machine shop and some more time in the Massachusetts apple orchards. Finally, around December the draft board found his name in the bottom of their barrel, and young Whittemore was off to Bainbridge and the Navy.

Long after Bill had tired of the Navy, the Navy finally tired of Bill, and he returned to Washington in time for the University's Fall registration in 1946.

Whittemore entered the School of Engineering, and perhaps out of curiosity as to what was going on in all the transmitters he had seen, chose the communications option and joined the student branch of the AIEE. In February of his freshman year he pledged Sigma Phi Epsilon fraternity. In the fall of 1947, the student branch of the IRE was formed, and Bill transferred his allegiance to that group. During this year he was elected secretary of Sigma Phi Epsilon.

Bill worked as a student assistant in the Physics lab during the summer of 1948 and returned to school in the fall to the job of social chairman of SPE—no easy job in a social fraternity.

In the spring of this year Bill was initiated into Theta Tau, the engineering professional fraternity. He was elected President of SPE at that time, a job involving much work while getting the fraternity settled into a new house, in addition to the usual chores of such an office. Simultaneously with this, he was elected President of the IRE, and appointed as their delegate to the Engineers' Council for the second year.

This summer was not completely wasted either. Bill conducted several meetings of the Engineers' Council, of which he is the president—a detail that escaped

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Engineering in the Nursery

by N. Czajkowski

Prepared for presentation before the Sigma Tau Fraternity

A little over three years ago, I was passing another milestone in my life when my wife announced that I was soon to become a father. Like all egotistical males, I began to make preparations for the arrival of my "son." He would have the best of things that I could afford, and to make a good start, plans were made to purchase items such as the bassinette, bathinette, crib, high chair, etc., with this view in mind.

When the day of great expectations arrived, my wife amazed me by launching into the sea of life two Amazons with a combined displaced tonnage of 14½ pounds. My initial disappointment with Mother Nature's failure to comply with my desire for a son was short lived, for I soon began pounding my chest at this production rate (attained without benefit of Professor Greeley's course in ME 126—Methods of Manufacture).

Soon, however, the original plan to buy the best of everything had to be altered, because my bank account would have been stretched well beyond its elastic limit.

It then became necessary to purchase the aforementioned items in the moderate or low price field. It seemed fair to assume that the price differential was due to refinements in appearance and durability and not in safety or utility.

My first experience that proved this assumption to be erroneous is Case I—"The Collapsible Bassinette." It can be collapsed and put away when the baby is not in it, but it also collapses with the baby in it, in which case the bassinette can be thrown away. After the first collapse I examined its design and soon found the cause of its failure.

When a load was put on the bassinette, the leg, of course, was in compression and the bracket was so designed that a moment existed there, tending to tear the bracket from the one tubular type rivet that fastened it to the bassinette. This led to the conclusion that certainly no professional engineer could have designed such a monstrosity. Any professional engineer would have designed the bracket so that the compression load would pass through the rivet, thus eliminating the upsetting moment at the bracket and putting the rivet in shear instead of tension.

Case II is that of the "Bunny Rabbit with Fish-hook Eyes." On Easter our children were given cotton-stuffed cloth bunny rabbits with eyeballs that rolled. Within two days the eyes were out of the bunny and in the children's mouths. Said eyes were buttons backed by stamped metal fasteners with jagged edges more lethal than any fish hook I've ever seen.

Case III is "The Case of the Vibrating Crib." When the children outgrew their bassinettes we put them in cribs, thinking that at last they were safe. At least the children enjoyed the added freedom of motion, for they jumped, played, and otherwise shook the cribs until almost every nut, bolt, and washer was rolling on the floor, from where, at their earliest convenience, they picked them up and put them in their mouths. How my wife managed to catch the children before they choked on these items, I'll never know. It would be unreasonable, perhaps, for the manufacturer to run a vibration test on this crib, but at least he could have used castellated nuts, lockwashers, or elastic nuts to prevent this condition.

There are other cases but time does not permit enumeration here. That my children are alive and well today after going through this gauntlet of lethal monstrosities for two years is a wonder to me.

I'm not in the possession of any statistics to prove my point, but my conviction is that the injury and mortality rate among children due to poorly designed nursery furniture and playthings is something to be ashamed of.

Two years ago the Hecht Company was sued by a mother whose little son was severely burned as a result of getting near a flame while wearing a cowboy suit, the chaps of which were made of a highly inflammable material. A New Jersey congressman at that time introduced a bill in Congress to prevent the manufacturer of this suit from using Interstate Commerce, in an effort to stop these tragedies.

The principal reason for this situation, to my way of thinking, is that these items are designed by craftsmen and not engineers. Although this type of engineering is not the glamorous sort, any engineer who invades this field, either by actual participation in manufacture or by using his influence with professional societies to establish codes or laws, will be performing his mission in life by doing a noble service to society.

(*Continued from page thirteen*)

earlier inclusion—and succeeded in setting up several successful schemes. Among these were the use of more students to aid in registration than ever before. Despite the screams of denial, registration lines were less disorderly than any time in the past. The rush was over completely before 1 p.m. A freshman advisory system was set up and a large number of freshmen were helped with schedule planning or at least given a different point of view on their confusion.

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(*Continued from page nine*)

and beer dispensing arrangements improved. This motion was unanimously carried.

A report on and discussion of the Engineers' library, located in the lounge in Corcoran Hall, was given by Bedford Robertson, president of Sigma Tau fraternity, which originally sponsored the library. After discussion, a motion that the library be discontinued and the reference books available be turned over to Lisner library was carried by a majority vote. Robertson also reported on the progress of plans by Sigma Tau for utilization of the George Washington ship's bell.

Several nominations for the position of member-at-large of the council were heard. R. F. Besier was elected. This post is filled each year by election, bringing the number of Council members to 14. The meeting was adjourned at ten o'clock.

(*Continued from page five*)

two reasons. First, it improves the efficiency of the plant, and secondly, it is not desirable to put relatively cold water into the boiler drums of high-pressure, high-temperature boilers such as are in this plant. The bled steam is a small part of the total, so that most of steam passes through the turbine. The steam entering the turbine is at 925 F and 850 psi pressure. This steam (except the bled steam) passes through 17 stages before being exhausted to the condenser. The steam flow when the generator is running at full load is 686,170 pounds per hour. The condensate is a high quality distilled water which is pumped back through the feedwater heaters into the boiler to repeat the cycle.

The condenser contains nearly 13,000 Admiralty metal tubes 26 feet long and ⅞-inch outside diameter, through which river water is pumped at the rate of 67,000 gallons per minute in order to cool and condense the exhaust steam from the turbine. The river water circulated through the condensers for the two 80,000 kilowatt turbines will be just about 193,000,000 gallons per day, which is more water than the entire city of Washington normally uses in a day.

These large quantities of river water are furnished to the condensers by huge vertical centrifugal pumps located in a pump house on the river bank. Before entering the pump house the water passes through a trash rack to block large objects from entering the system. The water then passes through intake screens of a ⅜-inch mesh to remove most of the remaining foreign matter. These screens can be rotated and sprayed clean. Large welded steel pipes 54 inches in diameter connect the pumps to the condensers. The same river water with nothing added to it except about 12 F of temperature, is returned to the river through an 84 inch diameter reinforced concrete pipe.

Electrical Facilities

Each of the 80,000 KW, 85% power factor generators will be directly connected to two 60,000 KYA transformers, to step up the energy from 13,800 to 69,000 volts for transmission to the load. Engineering studies showed this to be more economical than tying the generators together at low voltage, and stepping up through transformers tied directly to the 69,000 volts cables. The 13,800 volt generator leads to the transformer terminals are made of the isolated phase construction. These consist of three

20½ inch diameter outer aluminum enclosed, dust and vapor proofed pipes. Inside of each pipe a 6 inch copper tube is used as a conductor which is securely braced at each 90° angle and supported and insulated by porcelain insulators at five to eight foot intervals to withstand the shock of short circuit. It is expected that this type of construction will be trouble-free and will require inspection and cleaning only once every ten years.

Part of this isolated phase construction are the instrument transformers for the generator and 13,800 volt oil circuit breaker that feeds one station service 13,800 to 2,300 volt transformer directly off the leads of the generator. Station service transformers fed from the 69,000 volt bus are also available to the generating station.

Main step-up transformers are equipped with fans arranged to blow air on the radiators to permit carrying their rated load without excessive temperature rise. On the 69,000 volt side they are connected to the main station busses through pneumatically operated oil circuit breakers which are capable of opening short circuits of 2,500,000 KVA. The transformers, oil circuit breakers, and associated high voltage equipment are located in the switch yard west of the Power Plant building. Ultimate layout of the Plant provides for five sections of 69,000 volt bus, each fed by two 69,000 KVA transformers from different generators, and each feeding two to three 45,000 KVA cables. These cables are connected to the bus by oil circuit breakers similar to those connecting the transformers. In case of a short circuit, the proper breakers to disconnect the faulty equipmennt are opened automatically by relays. Normally, the bus sections will be tied together only through the generator transformers, although they can be tied directly together by means of oil circuit breakers when a generator is shut down for any reason. The purpose of this bus arrangement is to "cushion" and control the large amount of generated power and to prevent excessive short circuit currents at the generating station.

In spite of the heavy cost involved, it was necessary that all lines transmitting the energy away from the station be underground. Much of the territory between the plant and the City of Washington has been carefully landscaped to provide scenic approaches to the City, and the appearance of overhead lines would have been objectionable.

Studies showed that three 600 MCM conductor 69 KV cables in conduit would be more economical than higher voltage single conductor cables, or cables pulled in pipe. This was the highest voltage three conductor cable available and two such cables furnish sufficient capacity to load one 80,000 KW generator. Conductors and insulation are enclosed in a lead sheath and a nitrogen gas pressure of 35 to 45 pounds is maintained inside the cable. This is the first installation of medium pressure gas filled 69 KW cable in the world. The so-called "gas-filled" cable was preferred to "oil-filled" cable because of lower installation and maintenance costs. The outside of the lead sheath is reinforced by bronze tapes and the whole cable enclosed in a neoprene jacket for protection against mechanical and chemical damage and electrolysis.

Part of the cable route parallels the Mount Vernon Memorial Boulevard from the power plant to the airport. This section of the line is built in unstable soil since it was originally the old bed of the Potomac River before the fill was made for the National Airport. For this reason the cables in this section are of the submarine type covered with metallic armor, and no conduit is used. This permits movement of the cables without damage, when the earth support moves. Many of the features described above are novel but all are based upon sound engineering and the lines should give high quality service.

The other terminal of the cable is the War Substation which supplies the Pentagon Building. Here they will be tied to two existing cables feeding back into the Buzzard Point power plant located at First and V Streets, S.W., and from there into the Washington system.

Control Facilities

The electrical output of this generating station is under supervision of the operators in the Control House. This house, an extension from the west wall of the main building, is centrally located with respect to the main building and the 69 KV switchyard. Two bay windows in the Control Room provide the operators with a means of visible inspection of the 69 KV switchyard.

The Control Room, seventy by twenty-eight feet, contains all the control and protective equipment required for switching operations of generators, transformers and feeders. This Control Room is heated and ventilated as required for the comfort of the operators and is lighted by means of fluorescent fixtures to give adequate illumination with least possible reflection or glare from instrument faces. The control boards, having a bench section for control switches and vertical sections for indicators and relays, are placed on the arcs of circles with the

operator's desk near the center point. The generator control panels are in the center of the arc, directly in front of the operator's desk, with the outgoing 69 KV feeder panels on the left hand end and station service panels on the right hand end. The protective relays, not needing constant supervision, are on rear panels facing away from the operator. At one end of the room is the control and distribution board for the 125 volt direct current control power system required in order that heavy equipment, located remotely from the Control Room, may be operated.

The auxiliary power system controlled from this room, known as station service system, consists of a two section 2300 volt bus for each generating unit. Two sections are provided so that each generating unit may have duplicate auxiliary equipment connected to separable power sources for sake of continuous safe operation. Automatic protective equipment is provided to disconnect faulty equipment from the system. The 440 volt auxiliary power system for small equipment, under 50 h.p., is similarly arranged, and the use of dry type, air cooled transformers permits the physical arrangement of transformers and switchgear into an enclosed unit type substation, located indoors between the turbine and boiler.

(*Continued from page eleven*)

and negotiations are in progress now for excuses from all conflicting University classes for those who will be in attendance.

The year's social activities will also be initiated on November 2, when all student members of ASCE are invited to attend a dance at the Hotel Statler which will follow a meeting of our chapter here at the University.

The George Washington University student chapter has planned for this year what we believe is an outstanding program of interest to the student members. Plans have been laid for obtaining as speakers several of the better known figures in the engineering field for our technical meetings, many of which will be complemented by field trips led by competent engineers to further explain the subjects of discussion. In accordance with our conception of the social element as a necessary supplement to the educational side of engineering, several picnics and informal parties are planned for the coming year, beginning with a day of football and fun in mid-November which, of course, will be free to all members.

So—if you are a Civil Engineering student, or a BSE (considered along with CE's as potential and welcome members of ASCE) and have not as yet joined for the year 1949-1950, watch for the announcements of the first meeting. If you happen to see Gerald Summers, Bernie Crummett, or Tom Mutchler, before that time, they will be glad to accept your $3.00 membership fee. Remember, membership in the American Society of Civil Engineers should be considered the normal status for all Civil Engineering and Bachelor of Science in Engineering students at George Washington University. WEAR YOUR ASCE BADGE WITH PRIDE!

ENGINEERING SCHOOL CALENDAR

November - 1949

Nov. 1—Tuesday—A.S.C.E. Student Registration, Special student field trips, Dinner, and Evening Program.

Nov. 2—Wednesday—A.S.C.E. Dance at Hotel Statler.

Nov. 2—Wednesday—Societies Meet

Nov. 2, 3, 4—Wednesday, Thursday, Friday—National A.S.C.E. Conference at Hotel Statler, Washington, D. C.

Nov. 9—Wednesday—Sigma Tau Meeting

Nov. 11—Friday—Theta Tau Oyster Roast

Nov. 16—Wednesday—Theta Tau Meeting

Nov. 17—Thursday—Engineers Council Meeting

Nov. 23—Wednesday—Sigma Tau Meeting

Nov. 30—Wednesday—Theta Tau Meeting

Nov. 30—Wednesday—Mechelecic Out

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(*Continued from page six*)

fundamental characteristics in common. It also explains the difficulty which scientists encountered in the past in seeking to ascertain the precise charge-mass relationship, for unless the isotopes of the elements are treated as four distinct series, certain factors which will be explained elsewhere obscure recognition of the physical laws responsible for the heirarchy.

The Mass Increments Law

The second fundamental law governing the charge-mass heirarchy is:

Successive increments of charge and mass within a series must conform to the equation

N plus P = 4 M.U., and N must equal either 1, 2, 3 or 4.

Here, N and P represent the number of neutrons and protons in the increment. As each particle has one mass unit, the total number of particles in the increment cannot exceed four. As the charge or atomic number depends upon the number of protons, the increment charge will vary with the number of protons. Since the number of protons cannot be greater than 3, only four types of increments can occur, namely:

1. 1n/3p
2. 2n/2p
3. 3n/1p
4. 4n/0p

The 2n/2p increment is the alpha particle. The other three increments are modifications of that unit. Mass increments will hereafter be referred to as "quadriads"—a particle of 4 mass units and a variable charge which never exceeds 3. The term "increments" will be restricted to additive steps between successive nuclei of a series.

It is in the mass increments law that we find an explanation for the little understood observation that atomic nuclei appear to favor the alpha particle as a nuclear component. The quadriad increment maintains the integrity of the series; whenever a mass of less than 4 mass units is added to a nucleus of a series the result is an inter-series transition. Thus, the successful addition of 1 mass unit to the mass 39 nucleus of potassium would result in the transition from the Alpha to the Beta series, yielding mass 40 of calcium.

Law of Inter-Series Transition

The third fundamental law underlying the charge-mass heirarchy is:

The sum of the charge and mass of four 1-mass-unit particles successively added to a particular nucleus of a series will always equal the quadriad increment between that nucleus and the next succeeding nucleus of the same series.

This law states that if four mass units are added to a particular nucleus in stages of one mass unit, even though the particles may all be neutrons, if the series mass increment is a 1p/3n quadriad, then one of the neutrons will bring about the conversion of a neutron into a proton so that the net result conforms with the series mass increment. Often, the addition of a mass unit to a nucleus permits two alternative transitions, depending upon the location of the nucleus in the heirarchy. Thus at copper mass 63 the product of a 1-mass-unit increment may be either nickel mass 64 or zinc mass 64. We shall explain this phenomenon elsewhere.

Although there are four types of quadriads, they are not common to all systems. The 0p/4n increment is found only in the even mass series, Beta and Delta. The 3p/1n occurs only in the Alpha and Gamma series, at mass 139 and 141 respectively. The 1p/3n quadriad occurs only once in the even mass series, at mass 14 of Delta. This quadriad appears frequently in the two odd mass series, occurring a score of times in each. As would be expected, the alpha particle quadriad, consisting of two protons and two neutrons, is the type most frequently found. It accounts for the majority of mass increments, as it is the normal step in the mass accumulation cycle.

In the structure of nuclei nature seeks to achieve equal proton-neutron levels. As one proceeds from the light nuclei to the heavy, it is apparent that this ideal encounters difficulty. This results in the necessity of a series periodically reorganizing the structure of its nuclei.

Law of Periodic Displacement

The nuclei of a series are subject to periodic changes in the ratio of charge to mass, or proton- to neutron-level, whereby the series, where addition of a alpha particle cannot be made, deviate in a regular manner from the base ratio of 1 charge unit to 2 mass units. Such deviations of a particular series are always of the same kind. All nuclei of a series at a higher mass level than that at which the displacement occurs, are displaced as a group. The total charge deviation of a given nucleus from the 1:2 ratio is always the sum of the deviations which occurred at lower mass levels.

This law expresses the fact that a series is restricted as to the number of alpha particles increments which may occur in successive nuclei. When a saturation stage is reached in a series, a reorganization of the next nucleus is necessary, resulting in the modification of the alpha particle increment.

Law of Proton-Neutron Conversion

Every deviation of a nucleus of a series from the base ratio of charge to mass is the result of the conversion of either one or two protons into neutrons. The conversion of protons into neutrons is a periodic function of the increase of charge and mass.

This law explains the fact that while the usual mass increment in a series is the alpha particle, when saturation occurs the subsequent increment is a quadriad of either 1p/3n, 0p/4n or 3p/1n. Earlier, it was pointed out that the 0p/4n quadriad was restricted to the even mass series, while the 1p/3n increment occurs frequently in the odd mass series. It is this fun-

damental difference in the types of quadriad increments which accounts for a number of phenomena of the charge-mass heirarchy hitherto found inexplicable.

Series Shifting

From the isotopic configuration chart it is seen that the four series "shift" periodically, resulting in the horizontal displacement of the series by four columns, and the vertical displacement of one charge level. Each of these shifts in the even mass series marks a saturation stage in the mass accumulation cycle. The odd mass isotopes do not follow precisely the same process, as an intermediate adjustment in the proton-neutron level occurs before a shift. We may explain this in terms of the quadriad increments.

The even mass series proceed in increments of 2p/2n; when an even mass series reorganizes a 0p/4n increment occurs. This may or may not result in a series shift. If we define a shift as the displacement resulting in the termination of a cycle, then as mass 32 and 36 of the Beta series, we see that the series has branched, forming the isotopes oxygen mass 36 and argon mass 40. The complete shift does not occur until the calcium mass 40 isotope.

The phenomenon of branching may be attributed to the pressure to reorganize the proton-neutron ratio. Since even mass series are restricted to 2p/2n or 0p/4n increments (the unique 1p/3n increment at mass 14 of the Delta series is an exception explained by the nature of its base constant) these series cannot relieve the pressure to reorganize except by branching or shifting. The odd mass series are not so restricted. While the regular increments are 2p/2n quadriads, the odd series may convert a single proton whenever the pressure to reorganize demands, resulting in a 1p/3n increment. The first such increment changes the atomic number pattern from odd to even or vice versa. It also sets the charge progression back one unit. The second 1p/3n increment brings about an odd series shift. Such an atomic number switch prohibited the odd mass 37 for argon, and since mass 35 also went to chlorine, we find the inert gas has no odd mass isotopes. A similar conversion prevents cerium from having an odd mass isotope.

Since the series need not shift concurrently, or even in any particular order, there is considerable overlapping. This factor alone created such apparent confusion that the true nature of charge-mass heirarchy was obscured. It is significant, however, that shifts of the series, when occurring somewhat together, closely follow the periods of the chemical periodic table.

Why There are No Stable Nuclei for Atomic Numbers 43 and 61

Examination of the Z43 and Z61 area of the configuration chart shows that there are no isotopes for Z43 and Z61, either because of series shifts before crossing the Z43 and Z61 levels, or because at the time of crossing the four series were carrying even atomic numbers.

Missing N

Much speculation has been ventured regarding the non-existence of stable nuclei containing the odd N values 19, 21, 35, 39, 45, 61, 89, 115, and 123. Isotopes of even atomic number and even mass must have even numbers of protons and neutrons, therefore the occurrence of odd N is restricted to either isotopes of even atomic number and odd mass or to the four even mass isotopes of hydrogen, lithium, boron, and nitrogen. Inasmuch as odd mass isotopes are all distributed by the Alpha or Gamma series, the utilization of an odd N value will depend upon whether either series is running on odd or even charge when it crosses a particular level. It is obvious that to distribute an odd mass isotope to an element of even atomic number the number of neutrons utilized must be odd, since the mass is the sum of the even number of protons and the odd number of neutrons. If an odd mass goes to an odd atomic number, then the nucleus will contain an even number of neutrons. Thus each odd mass series has the choice of either an odd or even N value at each increment; if it selects the even value, then the odd N is excluded. We see at mass 35 that the Alpha series was running on even N values, while at mass 33 the proton conversion resulted in the Gamma series skipping the N 19 value. Thus, no stable isotope can possess 19 neutrons. The missing N value 21 is explained by the Alpha shift at mass 39 and the fact that the Gamma series is running on even N values at mass 37. Similar patterns account for every one of the missing N values.

Magic Number Nuclei

The laws governing the mass-charge heirarchy contradicts the so-called closed shell theory. It seems clear that the existence of 7 nuclei possessing 82 neutrons can be attributed to coincidence, rather than any inherent structural organization of the nucleus of the atoms involved. The factors responsible for the occurrence of the 7 nuclei are:

1. Normal utilization of the N level by three series, yielding the nuclei of Z 57, 58 and 56;

2. Branching of the Beta series at Z 54 and Z 62, and of the Delta series at Z 60;

3. Reorganization of the Gamma series at Z 59.

Normally, the four series may each utilize a given value; four nuclei containing 82 neutrons may occur in the normal course. Branching is a regular occurrence throughout the even mass series, and may occur in the odd series. Branching is a result of the pressure to reorganize; it is a sign of instability, rather than stability.

Examination of the N 81 level will reveal that five isotopes are necessary to maintain series continuity. The other two N 82 nuclei are the result of branching in the Beta series. Of greater significance are the three voids adjacent to Z54:136 and Z62:144. These voids indicate either undiscovered nuclei, or the instability of nuclei having proton-neutron levels required by the series at these points.

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